WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005IL63B

Title: Occurrence and Ecological Effects of Pharmaceutical Chemicals in Chicago Metropolitan Area Streams

Project Type: Research

Focus Categories: Water Quality, Toxic Substances, Ecology

Keywords: pharmaceuticals, aquatic macroinvertebrates, stream ecosystem dynamics

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: $20,000

Non-Federal Matching Funds: $40,360

Congressional District: 9

Principal Investigator:
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Abstract

An emerging concern in surface water quality is the presence of a novel suite of contaminants: pharmaceuticals and personal care products (PPCPs). Products used by humans such as painkillers, antibiotics, caffeine and hormones persist after their intended use, can enter wastewater treatment facilities in their original form or as metabolites, and be released as a component of wastewater treatment effluent to freshwater ecosystems. While, it is recognized that PPCPs are present in surface waters which receive wastewater treatment effluent, the ecological effects of these novel contaminants are not currently known. In addition, PPCPs were specifically designed to have a biological effect; therefore the likelihood that they will have consequences for biota may be high.

The presence of PPCPs may be a contributing factor in the degradation of urban streams. My previous research demonstrated that the quality of the basal food resource of an urban river food web, as measured by aquatic macroinvertebrate growth rates, declined with increasing permitted wastewater discharge. This decline was not related to conventional contaminants (e.g., metals) and I hypothesize that reduced food quality may be a result of PPCPs in wastewater effluent. Loyola University Chicago is uniquely situated within close proximity of surface waters receiving large amounts of wastewater effluent.

Because of this, I propose to investigate the ecological effects of these novel contaminants in the metropolitan Chicago area.

While detecting PPCPs in surface waters is relatively straightforward (new analytical tests are emerging at a rapid pace), determining their ecological significance is much more difficult. Urban streams are negatively affected in numerous ways and it is difficult to determine which aspect of urbanization is responsible for ecological degradation in the field. In order to overcome this limitation, I propose to use a newly built artificial stream facility at Loyola University Chicago to study effects of PPCPs on food resources and stream macroinvertebrates.

The specific research goals for this project include: 1) measure the concentration of PPCPs in surface waters of the Chicago metropolitan area and 2) measure the effects of 3 PPCPs on four major components of stream ecosystems: algae, detritus, grazers and shredders. Predicting of the effects of novel contaminants on stream ecosystems can be difficult. Therefore, I propose to simultaneously measure the effects of PPCPs on 4 trophic levels. This approach is possible because of the large number of artificial streams at Loyola University Chicago and the technique of measuring functional endpoints (i.e., growth rates, microbial metabolism, decomposition rates, etc) is relatively straightforward. The overall goal of this research proposal is to determine the effects of ecologically relevant concentrations of novel contaminants on stream ecosystem dynamics (food quality and macroinvertebrate growth rates), variables which have consequences throughout riverine foodwebs.